du Treil, Lundin & Rackley, Inc.
A Subsidiary of A. D. Ring, P.C.

COMMENTS OF
DU TREIL, LUNDIN & RACKLEY, INC.
IN ET DOCKET NO. 93-62

Introduction

These comments were prepared to address certain issues in the FCC's Notice of Proposed Rule Making in ET Docket No. 93-62, Adopted on March 11, 1993. As electronics engineering consultants to the communications industry, du Treil, Lundin & Rackley, Inc. (dLR) has had many years of experience dealing with the issue of radiofrequency (RF) radiation, its measurement and evaluation.

Controlled and Uncontrolled Environments

The application of newly defined controlled and uncontrolled environments which is suggested by the new ANSI/IEEE C95.1-1991 Standard (herein "ANSI/IEEE Standard") is one that dLR is very concerned about. There appear to be inconsistencies in the definitions of the controlled and uncontrolled environments in ANSI/IEEE Standard. The controlled and uncontrolled environments are defined as follows:

> **controlled environment.** Controlled environments are locations where there is exposure that may be incurred by persons who are aware of the potential for exposure as a concomitant of employment, by other cognizant persons, or as the incidental result of transient passage through areas where analysis shows the exposure levels may be above those shown in Table 2 but do not exceed those in Table 1, and where the

> induced currents may exceed the values in Table 2, Part B, but do not exceed the values in Table 1, Part B. (The means for identification of these areas is at the discretion of the operator of a source.)
>
> **uncontrolled environment**. Uncontrolled environments are locations where there is the exposure of individuals who have no knowledge or control of their exposure. The exposures may occur in living quarters or workplaces where there are no expectations that the exposure levels exceed those shown in Table 2 and where the induced currents do not exceed those in Table 2, Part B. Transitory exposures are treated in 4.1.1.

These appear inconsistent because a location is defined as controlled on uncontrolled depending upon the level of knowledge an individual has about her/his exposure. This means that the controlled or uncontrolled environment is an amorphous line that moves depending on who is within it. These definitions raise serious questions about what locations actually will be considered controlled or uncontrolled. If areas are to be defined as controlled or uncontrolled, better definitions would seem to be required. For example, a controlled environment is an area which is restricted from access by all except authorized personnel such as the fenced area around a tower. Otherwise, under the new ANSI/IEEE Standard there will be endless confusion. If the FCC adopts the ANSI/IEEE standard, to limit the inevitable confusion, we suggest that the FCC consider adopting the maximum permissible exposure (MPE) for the uncontrolled environment as universal.

We note that even if the FCC adopts the ANSI/IEEE Standard as written, the result will be a *de*

facto adoption of the MPE's for an uncontrolled environment only. Because of the difficulty in applying the controlled and uncontrolled environment definitions, it will behoove broadcasters to meet the MPEs for uncontrolled environments so that there will be no question as to its compliance. Given this and for the reasons discussed below, we believe that the FCC must undertake additional research to determine the real impact on broadcasters.

Induced and Contact Currents

The new ANSI/IEEE Standard includes induced and contact current limitations not considered in previous standards. This is a matter of very serious concern for dLR because it perceives that the FCC and the broadcasting industry have not fully considered the extraordinary impact this provision may have. This is because the ANSI/IEEE Standard would require extensive measurements of induced and contact currents; and compliance with the ANSI/IEEE Standard MPEs does not imply compliance with the induced and contact current limit.

Based on the existing literature it appears that there is, in fact, cause for concern about induced and contact currents. The recent paper "Induced Foot-Currents in Humans Exposed to Radio-Frequency EM Fields"[1] conducted induced current measurements at frequencies as

[1] Tofani, S., D'Amore, G., Fiandiano, G., Benedetto A., Gandhi O. P., and Chen, J. Y.: "Induced Foot-Currents in Humans Exposed to Radio-Frequency EM Fields", University of Utah, Salt Lake City, Utah.

high at 104 MHz. It was shown that currents approaching the ANSI/IEEE limit are induced in human beings exposed to electric fields which were as low as 30% of the ANSI/IEEE Standard MPE. The report of Jules Cohen entitled "An Analysis of ANSI/IEEE C95.1-1992 Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz" (August 3, 1993) included calculations which demonstrated that the induced current limits would be met when the electric field does not exceed 15% of the ANSI/IEEE MPE. Thus, for an FM or low VHF television broadcaster operating under 100 MHz to comply with the ANSI/IEEE Standard MPE it would actually have to meet a limitation of 15% of the electric or magnetic field MPE which is equivalent to 2.25% of the power density MPE. The *de facto* MPEs for FM and low VHF television stations based on induced current limitations are as follows:

	De Facto MPEs Considering Induced Current limitations (mW/cm^2)	
Frequency (MHz)	Controlled	Uncontrolled
30 - 100	0.0225	0.0045

These are very restrictive limitations indeed.

To illustrate what the impact of the above *de facto* MPEs may be, the following table was prepared showing the required antenna elevations necessary for one FM station to just meet the *de facto* MPE:

ERP (kW)	*De Facto* MPE (mW/cm^2)	Downward Relative Field Factor	Required Antenna Elevation Above Ground Level	
			(m)	(ft)
Controlled Environment				
6	0.0225	0.5	67	219
25	0.0225	0.4	109	358
50	0.0225	0.3	116	379
100	0.0225	0.2	109	358
Uncontrolled Environment				
6	0.0045	0.5	149	490
25	0.0045	0.4	244	800
50	0.0045	0.3	258	848
100	0.0045	0.2	244	800

The above data illustrate that an FM antenna will have to be elevated very high above ground level just to meet the *de facto* MPEs for an uncontrolled environment; and that is just for a single station. It appears that most FM stations will have a problem meeting the uncontrolled environment *de facto* MPEs because most FM antennas are below the heights indicated. Also the many multiple-use sites will have great difficulty meeting the requirements. This now calls into question whether facilities previously categorically excluded will now have to be considered under the new standard.

Another concern is the fact that the MPEs applicable to the VHF band are spatially-averaged with a

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time-averaging of 6 minutes, while the current limits deal with the current induced at a specific location (i.e. ankle) of the body time-averaged over 1 second. For example, it appears that land mobile stations may now be of concern because their transmitting time may significantly exceed the 1 second averaging-time for induced currents. This brings-up the new question of the applicability of correlating 6-minute time-averaged MPEs to essentially instantaneous induced-current limitations. It seems clear that the FCC must undertake a study to carefully determine the impact of these new induced and contact current requirements and how the new ANSI/IEEE Standard MPEs will be met.

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